Original Article

Antenatal Anxiety: Prevalence and Patterns in a Routine Obstetric Population

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Abstract

Introduction: Expectant mothers may appear anxious even during healthy pregnancies. Unfortunately, little is known about antenatal anxiety, and affected women may remain undetected and untreated. This study aimed to examine the prevalence, incidence, course and associations of high state anxiety in routine obstetric care. **Materials and Methods:** This was an observational prospective cohort study at a large maternity unit. Obstetric outpatients with low-risk singleton pregnancies were recruited during first trimester consultations. Participants provided sociodemographic data and completed the State-Trait Anxiety Inventory (STAI) and Edinburgh Postnatal Depression Scale. The STAI was re-administered at each subsequent trimester. **Results:** Prevalence and incidence of high state anxiety among 634 completers were 29.5% (95% CI 25.6%-33.6%) and 13.9% (95% CI 9.9%-18.0%), respectively. Anxiety was persistent in 17.0% (95% CI 14.3%-20.2%) and transient in 26.3% (95% CI 23.1%-29.9%). Only persistently anxious participants had high mean second trimester state anxiety scores. Odds for anxiety of greater persistence increased by 29% (95% CI 24%-35%) per 1-point increase in first trimester depression scores, and decreased by 36% (95% CI 7%-56%) with tertiary education. **Conclusion:** Antenatal anxiety symptoms are common even in normal pregnancies, especially among women with depression and lower education. Our study indicates value in exploring diagnostic criteria and quantitative measures for antenatal anxiety.

Introduction

Background

Anxiety disorders represent the pathological variant of a common human emotion, and are thought to evolve from childhood adversity leading to chronically increased stress reactivity.[1] A local study found that women are more than 3 times as likely as men to experience a generalised anxiety disorder.[2] During pregnancy, women may become even more anxiety-prone, which makes it difficult to identify pathological states.[3] It may be that the female's propensity to anxiety becomes exacerbated by pregnancy hormones.[4-6]

Another challenge with antenatal anxiety is that it often presents with elements of obsessive-compulsive disorder, generalised anxiety disorder or panic disorder, while falling short of meeting criteria for a specific diagnosis.[7] It may also overlap with depressive symptoms.[8]

Despite these issues, antenatal anxiety has been described as "a distinct and definable syndrome…closely associated with state anxiety…tied specifically to concerns about a current pregnancy".[9] These concerns are typically about maternal and fetal health, the birthing experience and the parenting role.[9,10] Antenatal anxiety consistently occurs more

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commonly than antenatal depression and postnatal anxiety.[10,11] It predisposes toward pre-eclampsia and postnatal mood disorders in affected mothers, and emotional and attention dysregulation in their children.[12-15] It also shows biological correlations with maternal hormones and inflammatory markers, and with neonatal brain morphology.[16-18]

However, a lack of formal clinical criteria and rating scales for antenatal anxiety impedes diagnosis and screening. Existing research is based on varying definitions and measurements. Known prevalence rates range widely from 11% to 60%.[7,11] With this level of uncertainty about antenatal anxiety, affected women may remain undetected, as obstetric care providers may not be fully aware of the potential burden of illness, and psychiatric care providers may not be fully equipped to recognise or manage this condition. The 2017 Confidential Enquiry into Maternal Deaths and Morbidity cited maternal suicide as the third largest cause of direct maternal deaths between 2013 and 2015 in the United Kingdom, and estimated that better care might have prevented this outcome in 26% of women with severe mental illness.[19] This indicates the importance of clinical awareness of common mental conditions during the perinatal period.

Objectives

We designed this study on antenatal state anxiety in a large group of women with low-risk pregnancies receiving regular routine obstetric care. Our primary aim was to: a) determine the prevalence and incidence of high antenatal state anxiety; and b) describe its course as pregnancy progresses, based on sequential measurements of state anxiety scores. Our secondary aim was to: c) examine the associations among antenatal state anxiety, first-trimester depressive symptoms and participants' sociodemographic characteristics.

Materials and Methods

Study Design and Setting

This observational prospective cohort study took place between July 2012 and April 2014. Participants with low-risk singleton pregnancies were systematically surveyed at each trimester, specifically at 11 to 14 weeks, 18 to 22 weeks and 28 to 32 weeks of gestation. The study protocol was approved by the Institutional Review Board (CIRB Ref 2010/214/D) and written informed consent was obtained from every participant. Refusal of, and withdrawal from, participation in this study did not impact the obstetric care provided to patients.

Participants

Participants comprised obstetric female outpatients under 14 weeks' gestation at recruitment, receiving routine antenatal care for singleton pregnancies deemed at low risk

of miscarriage. Women with multiple pregnancies, serious chronic medical conditions (such as autoimmune disorders and renal disease), and/or current/previous pregnancies complicated by chromosomal anomalies or cervical incompetence, were excluded from the study.

Variables and Data Sources

During their initial first trimester assessment at 11 to 14 gestational weeks, participants were asked by trained clinical research coordinators to provide basic demographic data, including age, race, education level and antenatal lifestyle habits. Previous studies have indicated that antenatal anxiety may be more common in the presence of maternal factors such as younger age, minority race, lower education, non-employment, smoking and drinking.[20,21] Participants also completed psychometric measures for anxiety and depression. The anxiety measure was re-administered during the second and third trimesters, so that participants had state anxiety scores for every trimester. Participants with high scores were advised about seeking psychiatric care, which was available in the same institution.

Spielberger State-Trait Anxiety Inventory (STAI)

The STAI has been validated in antenatal populations and is recommended as a research screening tool for general anxiety.[22] It consists of 40 self-administered items, each rated on a 4-point scale ranging from 1 to 4, with higher scores indicating greater severity. The first 20 items assess the respondent's current state anxiety (i.e. STAI-State subscale), while the latter 20 items assess the respondent's general predisposition to anxiety (i.e. STAI-Trait subscale). The STAI-State subscale was our primary outcome measure for high antenatal state anxiety. These scores are generally interpreted based on cutoff scores for population-specific normative data, which are unfortunately lacking in the local setting. However, a 2013 Singaporean study found a cutoff score of 43 to yield 84% sensitivity and 59% specificity in identifying clinical antenatal anxiety.[23] We therefore used this cutoff score to define high state anxiety. The STAI-Trait subscale was not used in this study because it may be unstable during the perinatal period, with low test-retest reliability.[3]

Repeated measures are recommended during pregnancy because 50% of positive scores for emotional distress resolve within a fortnight.[24] To differentiate clinically significant symptoms from transient distress, we defined 'persistent anxiety' as STAI-State scores of 43 or more in at least 2 consecutive trimesters. Participants with STAI-State scores of 43 or more in either 1 or 2 non-consecutive trimesters were defined as having 'transient anxiety', while those who scored 42 or less in all trimesters were defined as 'non-anxious'. We believe these definitions to be more

stringent and clinically meaningful than simply performing a single assessment for the entire pregnancy.

Edinburgh Postnatal Depression Scale (EPDS)

The EPDS is also a self-administered screening questionnaire. It consists of 10 items, each rated on a 4-point scale ranging from 0 to 3, with higher scores indicating greater severity. Although it was developed as a screening tool for postnatal depression, it has also been used to screen for antenatal major depression using a cutoff score of 15 or more.[25]

Missing Data

Questionnaires were checked for completion by the clinical research coordinators during each assessment. The completers answered over 99.5% of all questions in the STAI and EPDS. Blanks were filled using individual mean imputation, which is a valid method of handling small proportions of missing data from ordinally-scaled instruments.[26]

Bias

As both the STAI and EPDS are screening instruments, our results may overestimate the prevalence of true clinical disorders.

Study Size

This study represented a secondary analysis of a main study to prospectively examine adverse physical and psychological obstetric outcomes, in which 3271 patients were non-selectively approached. Among these, 451 patients were ineligible due to non-viable pregnancies, uterine malformations, communication problems and gestational age above 14 weeks. Among the 2820 eligible patients, 909 patients agreed to participate and had delivered by the end of the study period.

Statistical Methods

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, IBM Statistics) software version 19.0. Calculations of period-specific prevalence and incidence of antenatal anxiety were based on the proportion of participants scoring 43 or more on the STAI-State subscale in each trimester. The 95% confidence intervals (CIs) of these proportions were estimated using the Wilson-score method.

The course of antenatal anxiety was defined by the proportions of participants in each of the 3 anxiety subgroups (i.e. 'non-anxious', 'transiently anxious' and 'persistently anxious', as described under STAI section).

The simultaneous 95% CIs of these multinomial proportions were estimated using the Sison-Glaz method.[27] Mean STAI-State scores, with standard deviations (SD),

of each anxiety subgroup at each trimester were plotted to graphically present changes over the course of pregnancy.

To examine associations among antenatal state anxiety, sociodemographic factors and first trimester depressive symptoms, we performed an ordinal logistic regression using 'non-anxious', 'transiently anxious' and 'persistently anxious' statuses as response variables, with the 'non-anxious' subgroup as the reference class. We entered all prespecified sociodemographic factors and first trimester EPDS scores as independent variables into the regression model. Variables with regression coefficients statistically significant at the 5% level of significance were considered associated with anxiety subgroup status. Associations were quantified using adjusted odds ratios (ORs) and their corresponding 95% CIs.

To assess the impact of attrition, we examined differences in sociodemographic and baseline clinical characteristics between participants who completed versus those who did not complete the study, by comparing distributions using the chi-squared test for categorical variables and the 1-way analysis of variance (ANOVA) test for interval-scaled variables.

Results

Participants

Among 909 participants, 69.7% completed assessments in all 3 trimesters ('completers'). The remaining 30.3% of the sample were considered to be 'non-completers'.

Descriptive Data

The 909 participants were aged 17 to 45 years (mean 30 years, SD 5 years) and the racial distribution was 48.5% Chinese, 29.5% Malay, 11.9% Indian and 9.9% other races. For comparison, the national ethnic mix in 2015 was 76.2% Chinese, 15.0% Malay, 7.4% Indian and 1.4% other races.[28] In addition, 91.7% of our participants were married, 63.8% had at least tertiary education and 78.0% were employed.

Table 1 summarises the demographic characteristics of the 909 participants, with comparisons: a) among the 3 anxiety subgroups; and b) between completers and non-completers. Among the 3 anxiety subgroups, univariate analyses reveal differences in age, marital status, educational level and smoking habits. The only difference between the completers and non-completers was that the latter were more likely to belong to minority ethnic groups (OR 1.511, 95% CI 1.085-2.106, *P* = 0.014).

Prevalence and Incidence of High State Anxiety

Table 2 shows the prevalence and incidence of high state anxiety in the 634 completers. Among the 187 who were anxious during the first trimester (i.e. with prevalent state anxiety), one-third were anxious throughout pregnancy, while half were no longer anxious by the third trimester,

Table 1. Participants' Demographics with Comparisons: (A) among Anxiety Subgroups; and (B) between Completers and Non-Completers

	(A) Completers (n = 634)				(B) All Participants (n = 909)		
	Persistent Anxiety	Transient Anxiety	No Anxiety	*P* Value	Completers	Non-Completers	*P* Value
n (%)	108 (17.0)	167 (26.3)	359 (56.6)	-	634 (69.7)	275 (30.3)	-
Age range, y	17 – 44	18 – 42	19 – 44	-	17 – 44	17 – 45	-
Mean, y ± SD	29 ± 5	30 ± 5	31 ± 5	0.019*	30 ± 5	31 ± 5	0.477
Race, n (%)							
Chinese	48 (44.4)	87 (52.1)	195 (54.3)	0.612	330 (52.1)	111 (40.7)	0.011*
Malay	37 (34.3)	45 (26.9)	97 (27.0)	0.612	179 (28.2)	89 (32.6)	0.011*
Indian	14 (13.0)	18 (10.8)	34 (9.5)	0.612	66 (10.4)	42 (15.4)	0.011*
Others	9 (8.3)	17 (10.2)	33 (9.2)	0.612	59 (9.3)	31 (11.4)	0.011*
Marital status, n (%)							
Married	92 (85.2)	156 (93.4)	330 (91.9)	0.047*	578 (91.2)	256 (93.8)	0.186
Unmarried		11 (6.6)	29 (8.1)	0.047*	56 (8.8)	17 (6.2)	0.186
Education, n (%)							
Non-tertiary	62 (57.4)	63 (37.7)	110 (30.6)	<0.001†	235 (37.1)	94 (34.2)	0.406
Tertiary	46 (42.6)	104 (62.3)	249 (69.4)	<0.001†	399 (62.9)	181 (65.8)	0.406
Employment status, n (%)							
Employed	80 (74.1)	133 (79.6)	290 (80.8)	0.318	503 (79.3)	206 (75.5)	0.194
Not employed	28 (25.9)	34 (20.4)	69 (19.2)	0.318	131 (20.7)	67 (24.5)	0.194
Housing type, n (%)							
Public	104 (96.3)	159 (95.2)	328 (91.4)	0.099	591 (93.2)	255 (93.4)	0.917
Private	4 (3.7)	8 (4.8)	31 (8.6)	0.099	43 (6.8)	18 (6.6)	0.917
Antenatal smoking, n (%)							
Smoking	8 (7.4)	3 (1.8)	4 (1.1)	0.001*	15 (2.4)	12 (4.4)	0.099
No smoking	100 (92.6)	164 (98.2)	355 (98.9)	0.001*	619 (97.6)	261 (95.6)	0.099
Antenatal alcohol use, n (%)							
Drinking	2 (1.9)	1 (0.6)	6 (1.7)	0.574	9 (1.4)	3 (1.1)	0.698
No drinking	106 (98.1)	166 (99.4)	353 (98.3)	0.574	625 (98.6)	270 (98.9)	0.698
Antenatal recreational drug use, n (%)							
Drug use	0 (0)	0 (0)	0 (0)	NA	0 (0)	0 (0)	NA
No drug use	108 (100)	167 (100)	359 (100)	NA	634 (100)	273 (100)	NA
Antenatal coffee consumption, n (%)							
Coffee	24 (22.2)	33 (19.8)	78 (21.7)	0.848	135 (21.3)	52 (19.0)	0.443
No coffee	84 (77.8)	134 (80.2)	281 (78.3)	0.848	499 (78.7)	221 (81.0)	0.443
Antenatal regular exercise, n (%)							
Exercise	4 (3.7)	12 (7.2)	24 (6.7)	0.462	40 (6.3)	13 (4.8)	0.362
No exercise	104 (96.3)	155 (92.8)	335 (93.3)	0.462	594 (93.7)	260 (95.2)	0.362
Antenatal dietary supplement use, n (%)							
Supplements	98 (90.7)	155 (92.8)	326 (90.8)	0.728	579 (91.3)	250 (91.6)	0.902
No supplements	10 (9.3)	12 (7.2)	33 (9.2)	0.728	55 (8.7)	23 (8.4)	0.902

NA: Not applicable
*Significant at *P* <0.05.
†Significant at *P* <0.001.
Percentages apply to column data. Missing data were excluded from the analysis.

Table 2. Prevalence and Incidence of Anxiety among Study Completers (n = 634)

Anxiety Typology	Description	Trimester*			n	%	95% CI
		1st	2nd	3rd			
Never anxious	-	0	0	0	359	56.6	52.7 – 60.7
Prevalent anxiety							
	Anxious at 1st trimester				187	29.5	25.6 – 33.6
	Resolved at 2nd trimester	1	0	0	74	36.6†	32.1 – 47.1
	Resolved at 2nd but recurred at 3rd trimester	1	0	1	23	12.3†	4.8 – 19.8
	Resolves at 3rd trimester	1	1	0	26	13.9†	6.4 – 21.4
	Anxious at all trimesters	1	1	1	64	34.2†	26.7 – 41.8
Incident anxiety							
	Developed anxiety after 1st trimester				88	13.9	9.9 – 18.0
	Incident at 2nd and persisted at 3rd trimester	0	1	1	18	20.4‡	10.2 – 31.7
	Incident at 2nd and resolved at 3rd trimester	0	1	0	25	28.4‡	18.2 – 39.7
	Incident at 3rd trimester	0	0	1	45	51.1‡	40.9 – 62.4

CI: Confidence interval

*0 = not anxious (STAI-State score <43), 1 = anxious (STAI-State score ≥43).

†Total n = 187, 95% CI computed using Sison-Graz method for multinomial proportions with 4 categories.

‡Total n = 88, 95% CI computed using Sison-Graz method for multinomial proportions with 3 categories.

and the remainder had anxiety that resolved in the second trimester but recurred in the third. Among the 88 completers who developed anxiety after the first trimester (i.e. with incident state anxiety), half did so during the second trimester, of which half continued being anxious in the third trimester. In total, 23.7% (95% CI 20.5%-27.1%) of all completers were anxious during the third trimester.

Course of High Antenatal State Anxiety

Among the 634 completers, 17.0% (95% CI 14.3%-20.2%) were persistently anxious. Transient anxiety affected 26.3% (95% CI 23.1%-29.9%) while 56.6% (95% CI 52.7%-60.4%) were not anxious. As expected, the persistently anxious subgroup had the highest overall mean STAI-State score of 47.8 (95% CI 46.9-48.7), while the transiently anxious subgroup averaged 39.1 (95% CI 38.4-39.7) and the non-anxious subgroup 29.8 (95% CI 29.3-30.3).

Figure 1 shows the progression of STAI-State scores by trimester of the 634 completers. The persistently anxious subgroup was unique in scoring higher in the second than in the third trimester (49.1 [SD 4.8] vs 47.5 [SD 7.4], P = 0.031). Within this subgroup, 75.9% (95% CI 67.1%-83.1%) remained anxious in the third trimester. Among the transiently anxious subgroup, 40.7% (95% CI 33.6%-48.3%) were anxious in the third trimester.

Associations with Demographic Characteristics and First Trimester Depressive Symptoms

The completers' first-trimester EPDS scores ranged from 0 to 26, with mean 8.0 (SD 4.9). Their demographic characteristics (except drug use, as it was reported by none)

and first trimester EPDS scores were included as variables in our ordinal logistic regression model, the detailed results of which are presented in Table 3. Each 1-point increase in first trimester EPDS score was associated with an increment of 29% (95% CI 24%-35%) in the odds of being in a more persistent state of anxiety, while having a tertiary education was associated with a reduction of 36% (95% CI 7%-56%) in the same.

Discussion

Key Results and Interpretation

High antenatal state anxiety was common, occurring in nearly half of our participants. Most of the anxious participants were already anxious by the first trimester. However, most of them were no longer anxious by the third
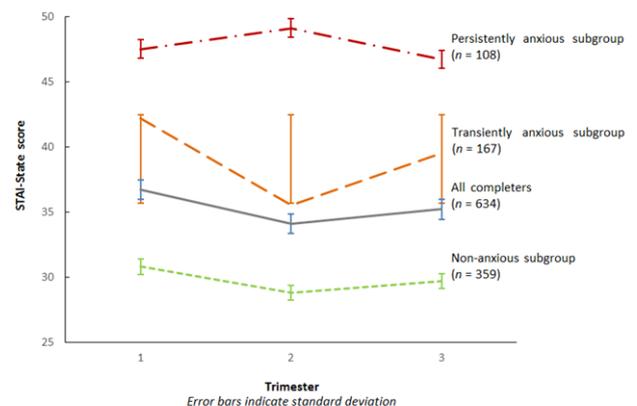

Fig. 1. Graph showing the mean STAI-State scores at each trimester. STAI: State-Trait Anxiety Inventory.

Table 3. Analysis by Ordinal Logistic Regression of Variables Associated with Antenatal Anxiety Subgroup

Variable	Estimate	Standard Error	*P* Value	Adjusted OR	95% CI
Age	-0.002	0.018	0.905	1.00	0.96 – 1.03
EPDS score	0.257	0.021	<0.001*	1.29	1.24 – 1.35
Race					
Chinese	-0.028	0.314	0.930	0.97	0.53 – 1.80
Malay	-0.311	0.337	0.356	0.73	0.38 – 1.42
Indian	0.012	0.386	0.976	1.01	0.48 – 2.15
Others	0.000			1.00	
Marital status					
Married	0.081	0.315	0.796	1.08	0.58 – 2.01
Not married	0.000			1.00	
Education					
Tertiary	-0.450	0.190	0.018†	0.64	0.44 – 0.93
Non-tertiary	0.000			1.00	
Employment status					
Employed	0.082	0.219	0.709	1.09	0.71 – 1.67
Not employed	0.000			1.00	
Housing type					
Private	-0.484	0.376	0.198	0.62	0.29 – 1.29
Public	0.000			1.00	
Antenatal smoking					
No smoking	-1.038	0.578	0.073	0.35	0.11 – 1.10
Smoking	0.000			1.00	
Antenatal alcohol use					
No drinking	0.615	0.837	0.463	1.85	0.36 – 9.53
Drinking	0.000			1.00	
Antenatal coffee consumption					
No coffee	-0.098	0.215	0.649	0.91	0.60 – 1.38
Coffee	0.000			1.00	
Antenatal regular exercise					
Exercise	0.161	0.356	0.651	1.17	0.58 – 2.36
No exercise	0.000			1.00	
Antenatal dietary supplement use					
Supplements	0.155	0.307	0.614	1.17	0.64 – 2.13
No supplements	0.000			1.00	

CI: Confidence interval; EPDS: Edinburgh Postnatal Depression Scale; OR: Odds ratio
*Significant at *P* <0.001.
†Significant at *P* <0.05.

trimester, likely indicating transient emotional distress caused by common pregnancy-related stressors. Even in normal pregnancies, the first trimester is often a period of uncertainty because most miscarriages and investigations for fetal anomalies happen during this time, while the third trimester is often a period of anticipation and physical discomfort.

Persistent state anxiety, which is more likely to be clinically significant, was observed in 17.0% of our participants. In comparison, a previous Singaporean study diagnosed anxiety disorders in 12.5% of high-risk pregnancies.[23] We postulate that our figure is higher due to our use of a screening scale, necessitated by our larger study size; also, we assessed for state anxiety instead of disorder-specific diagnostic criteria. A Hong Kong study

that measured antenatal anxiety on a scale that was also not disorder-specific found that 17.8% of its participants were anxious during all 3 trimesters.[21]

Persistently anxious participants were unique in having high STAI-State scores in the second trimester, which is usually a period of relative obstetric and emotional stability.[29] We believe this finding of high second trimester state anxiety to be novel, elicited through our approach of repeated assessments and stratification by anxiety subgroup. If supported by subsequent research, it may identify the second trimester as an optimal time to screen pregnant women for clinically significant anxiety, enabling early and appropriate referrals for psychiatric care.

Compared with any demographic characteristic, first trimester EPDS scores showed the strongest association with high state anxiety. The overlap between depression and anxiety in the general population has been recognised for decades and is thought to be due to genetic, biological and neurodevelopmental similarities in the 2 conditions.[30,31] Our results suggest that this overlap also exists in pregnant women, with the clinical implication that women who present with ostensibly 1 of these disorders should be assessed for the other.

The only demographic characteristic significantly associated with antenatal anxiety was lack of tertiary education. Higher education is linked with higher employment rates and income, and highly educated people tend to enjoy better health and are more likely than their counterparts to seek medical treatment early when ill.[32,33] Given the high value placed on education and achievement in Singapore, and that nearly two-thirds of our participants had a tertiary education, it is probable that the less educated minority lacked advantages and means that may have protected against anxiety.

Limitations and Generalisability

One main limitation was difficulty in defining and measuring antenatal anxiety. Existing studies have taken different approaches to this condition, and STAI scores may be interpreted variously, based on cutoff scores for population-specific normative data, which may differ among countries. Our novel method of sequentially administrating and interpreting the STAI has not been validated for diagnostic and prognostic accuracy. Nonetheless, our cutoff was supported by existing local data.[23]

Second, the unknown anxiety status of the non-completers may have led to inaccuracies in our prevalence estimations. However, existing studies suggest that dropouts tend to be depressed rather than anxious. Hence, we may not have underestimated the prevalence and incidence of anxiety.[34,35] Third, the data we obtained were participant-reported and may have been affected by reporting heterogeneity among

individuals. Fourth, our study was not powered to detect the effects of all included sociodemographic variables such as smoking, which occurred in a distinct minority. Also, the direction of causality between anxiety and lifestyle practices could not be ascertained.

The generalisability of our results may be limited by participation and attrition biases. The racial distribution in our study differed from that of the country in general as we had a smaller proportion of Chinese participants. The completers made regular attendances, which implies that they were invested in this model of obstetric care and open to psychometric assessment, while the non-completers differed in race and may have had different values and practices that could have impacted their mental health in ways unknown to us.

Conclusion

Despite its limitations, our study has clear strengths. It is one of the largest prevalence studies of antenatal anxiety in an Asian population, and is one of the rare few to conduct assessments at every trimester, instead of just once during the entire pregnancy. This provided a temporal element with which to differentiate persistent from transient anxiety, the former being more likely to be clinically significant. Finally, we recruited non-selected participants with normal pregnancies, most of whom completed all assessments, thereby yielding results that may be useful as baseline information for clinical and research purposes.

In summary, we found antenatal anxiety symptoms to be common in routine obstetric practice, with 1 in 6 participants experiencing them persistently. A novel finding was that these participants remained anxious even during the second trimester, which is typically a period of relative physical and emotional stability. First trimester depression and lack of tertiary education were identified as factors significantly associated with antenatal anxiety. Our findings indicate value in developing diagnostic criteria and quantitative measures for antenatal anxiety, so that affected women may be detected and treated appropriately.

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